

**QUARTERLY FOCUS ISSUE: HEART RHYTHM DISORDERS****Editorial Comment**

# Transesophageal Echocardiography Before Atrial Fibrillation Ablation

## Looking Before Cooking\*

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In many electrophysiology laboratories, atrial fibrillation (AF) is becoming the most common heart rhythm disorder being treated with catheter ablation. Reasons for this include the large numbers of patients with AF, the poor quality of life commonly associated with AF, the limitations of drug therapy, advances in ablation tools and methods, and the increasing number of electrophysiologists trained in the technique. Catheter ablation is now recognized as a legitimate option for patients with symptomatic AF who have failed antiarrhythmic drug therapy (1).

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A potential complication associated with catheter ablation for AF is stroke. Although the incidence of thromboembolism is low, with reports ranging from 0% to 7% (2), a stroke is clearly a devastating complication. Possible mechanisms of thromboembolism are dislodgement of a left atrial clot that was present before the procedure, thrombus formation on left atrial guide sheaths or ablation catheters, char formation at the electrode-tissue interface, and thrombus formation at the ablation sites where there is endothelial disruption. Therefore, many steps have become part of the ablation procedure solely to reduce the risk of stroke. These steps include the use of transesophageal echocardiography (TEE) to exclude a left atrial thrombus before the procedure, use of high-dose intravenous heparin after, or at some centers before, transseptal catheterization, intentional continuation of warfarin therapy at the time of the procedure at some centers, use of intracardiac echocardiography to monitor for catheter-associated thrombus formation during the procedure, continuous flushing of guide sheaths with heparinized saline, use of an open-irrigation ablation electrode, and limits on the duration and power of energy delivery.

The threshold of an electrophysiologist to order a TEE before an AF ablation is low, because a stroke is a potentially

avoidable complication and because performance of a TEE is usually considered benign. At many centers it has become routine to perform a TEE before an AF ablation for every patient. However, like most tests in medicine, one must examine the risks, benefits, and costs of this pre-procedural TEE. Factors that must be considered are the risk to the patient, the additional cost of the procedure, the negative impact of a TEE on the workflow in the electrophysiology laboratory, the overall experience from a patient perspective, alternatives to a TEE to identify a left atrial appendage clot, and the likelihood that a clot will actually be found.

What is the risk of a TEE before an AF ablation procedure? In a recent single-center series that included 10,000 TEEs performed over 10 years by 9 different attending physicians, each of whom had been performing TEE studies for at least 1 year, there was only 1 case of hypopharyngeal perforation, 2 cases of cervical esophageal perforation, and no cases of gastric perforation (3). There were no fatalities reported in this series. However, in a separate report on the prevalence and causes of a fatal outcome in catheter ablation for AF, 1 of the reported deaths was caused by an esophageal perforation from an intraoperative TEE probe (4). In the ACUTE (Assessment of Cardioversion Using Transesophageal Echocardiography) trial, which compared a TEE approach to 3 weeks of therapeutic oral anticoagulation before electrical cardioversion for AF (5), no complications related to performance of a TEE were reported. Therefore, based on the literature, the likelihood that a TEE examination by an experienced operator will result in a major complication appears to be very low.

What is the cost of a TEE? The cost, at least from a professional fee reimbursement perspective, is low. The 2009 Medicare reimbursement for a TEE is only \$326. Although there has not been a cost analysis of TEE examinations before catheter ablation procedures, there has been an economic analysis of TEE examinations before cardioversion. Investigators from the ACUTE trial found that, compared with a strategy of 3 weeks of anticoagulation before cardioversion, a TEE strategy had higher initial treatment costs. However, the cost of the TEE represented

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a relatively small portion of the total 8-week management cost, and the outcome-associated costs of the TEE were lower because fewer patients who underwent a TEE approach had a bleeding complication. Therefore, relatively little cost savings would be generated by eliminating the need for a TEE before an ablation procedure. In addition, the small cost of a TEE might be worth the economic investment if it avoids even a few strokes.

What is the impact of a TEE on the workflow in the electrophysiology laboratory? The impact that a TEE has on the workflow is dependent on many variables that include where, when, and how efficiently the study is performed. An approach that minimizes interruption of the electrophysiology laboratory flow is for patients to undergo a TEE before the day of the ablation procedure. Often patients undergo a computed tomography scan of the left atrium and pulmonary veins before an AF ablation procedure. A practical approach is to have the TEE performed on the day of the computed tomography scan.

What is the overall experience from a patient perspective of undergoing a TEE? A study of over 100,000 TEE examinations found that the probe could not be passed because of a lack of patient cooperation and/or operator experience in almost 2% of patients, and the probe had to be removed prematurely in almost 0.5% because of patient intolerance (6). In the ACUTE trial, the probe was unable to be passed in only 7 of 619 patients assigned to the TEE group. In fact, it is not uncommon that the biggest complaint by a patient after a cardioversion or an electrophysiology procedure is the TEE experience. For this reason alone, it would be nice to avoid a TEE if possible.

What are the alternatives to a TEE? There is no comparable alternative to a TEE that allows for visualization of the entire left atrial appendage to confidently and reliably rule out a thrombus. Alternatives such as multidetector computed tomography (7) and intracardiac echocardiography (8) are promising, but TEE remains the gold standard.

What is the likelihood of finding a clot at the time of TEE? In the ACUTE trial, 14% of patients who underwent a TEE examination before cardioversion were found to have an atrial thrombus, and the thrombus was located in the left atrial appendage in 88% of cases. Unlike most patients scheduled for an AF ablation, however, these patients were not treated with long-term oral anticoagulation before the TEE. In this issue of the *Journal*, the group from the Cleveland Clinic Foundation (9) examined the results of over 1,000 TEEs performed immediately before a catheter ablation procedure for AF. Few centers can present an experience of this magnitude. The degree of blood stasis was categorized as thrombus, sludge, and spontaneous echo contrast. They found that left atrial thrombus and sludge were present in only 0.6% and 1.5% of patients, but that the prevalence of left atrial/left atrial appendage thrombus/sludge increased with ascending CHADS<sub>2</sub> score (scores 0 [0%], 1 [2%], 2 [5%], 3 [9%], and 4 to 6 [11%],  $p < 0.01$ ).

Interestingly, 1% of patients who were in sinus rhythm at the time of the TEE had thrombus or sludge. The only subgroup of patients who had no risk of a clot or sludge were patients with a CHADS<sub>2</sub> score of 0.

The 2007 Heart Rhythm Society/European Heart Rhythm Association/European Cardiac Arrhythmia Society Expert Consensus Statement on Catheter and Surgical Ablation of Atrial Fibrillation recommends that “patients with persistent AF who are in AF at the time of ablation should have a TEE performed... regardless of whether they have been anticoagulated with warfarin prior to ablation... The yield of LA thrombus identification with TEE among patients with paroxysmal AF who are in sinus rhythm at the time of ablation is very low, particularly in patients without structural heart disease or risk factors for stroke. Some Task Force members do not routinely perform pre-procedure screening with TEE in this setting” (2). These new results from the Cleveland Clinic study, however, show that there is a 1% risk of finding a thrombus or sludge even in patients who present for their ablation procedure in sinus rhythm when the CHADS<sub>2</sub> score is  $\geq 1$ . Therefore, although there are some additional risks, inconveniences, and costs, it seems that the only patients who do not need a TEE before an AF ablation are those who present for the procedure in sinus rhythm and have a CHADS<sub>2</sub> score of 0. The fact that this topic continues to resonate with electrophysiologists argues for development of an accurate, inexpensive, and well-tolerated alternative to a TEE that can evaluate the left atrium for the presence or absence of a thrombus.

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